THE ANATOMY OF THE PERITONÆUM

FRANKLIN DEXTER, M. D.

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BY

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PREFACE.

From my experience in the dissecting-room, there seems to me to be no part of anatomy which is quite so unsatisfactory or incomprehensible to the student as the peritonæum. It is impossible to offer an explanation of why anatomical conditions present themselves as we find them, but in some cases, at least, we can explain how such conditions are produced, and if one understands this his knowledge is of a more satisfactory kind, and does not degenerate to a mere matter of memory. Moreover, if one follows the development of the organs, and is able to understand the changes produced in the abdominal cavity by this, he not only gains valuable information as to their normal position, but can more easily understand the abnormities that occur. There is no way of obtaining a clear idea of the peritonæum except through a knowledge of its development. It is this belief which suggested to me the writing of this pamphlet. The matter contained in it is not original in any sense of the word.

I believe it was Prof. Toldt, of Vienna, who first gave the true description of the development of the peritonæum. His article was, of course, written in German, and therefore is useless to most of our students. It seemed to me that if one should take his description as a basis, make many more plates than he gives in his work, and so take the student along, step by step, in the most elementary way, he would not only be able to follow the description with comparative ease, but in the end would have an understanding of the subject. It is with this idea that this pamphlet is offered to students of anatomy. To those further advanced in the science, the sketches will seem far too diagrammatic to coincide with accuracy—and I agree with them—but I have tried to keep the main object in view, namely, that it is not the embryological details which the student is trying to learn, but their result. For this reason it has been made most diagrammatical, with the hope that he will more easily be enabled to follow each step in the development. There is much in regard to the development of the liver and diaphragm which is not understood, and therefore the simplest possible explanation has been chosen. Even though in some details it be incorrect, it may aid the student in obtaining an idea of the peritoneal connections between the organs. Should this pamphlet give the required aid, its object will have been accomplished.

I would here express my sincere thanks to Prof. C. S. Minot, of Harvard University, as well as to Prof. George S. Huntington, of the College of Physicians and Surgeons, Columbia University, for the aid and many valuable suggestions which they have given me; as well as acknowledge my indebtedness to my former teacher, Dr. F. Hochstetter, assistant at the Vienna University, for the many hours which we have passed together in the study of this subject. I am also indebted to Toldt, Hertwig, Gegenbauer, Quain, and Gray, for sketches taken from their works.

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DEVELOPMENT OF THE ALIMENTARY CANAL.

Fig. I.

Median section of an embryo. In a very young embryo the alimentary canal resembles a tube in its form.

Fig. II.

At a later date a slight enlargement occurs in it, which is the first indication of the stomach, and inferiorly the canal makes a distinct bend.

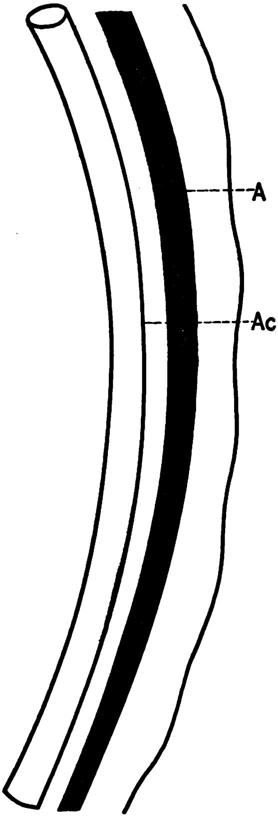

Fig. I.—A, Aorta. Ac, Alimentary canal.

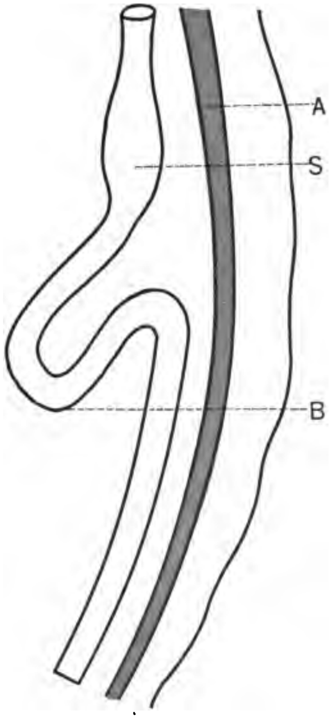

Fig. II. — S, Rudimentary stomach. A, Aorta. B, Bend in intestine.

Fig. III.

The enlargement (stomach) increases in size, the bend in the intestine grows more pronounced, and the lowest loop of the bend is approximated to the upper part of the intestine.

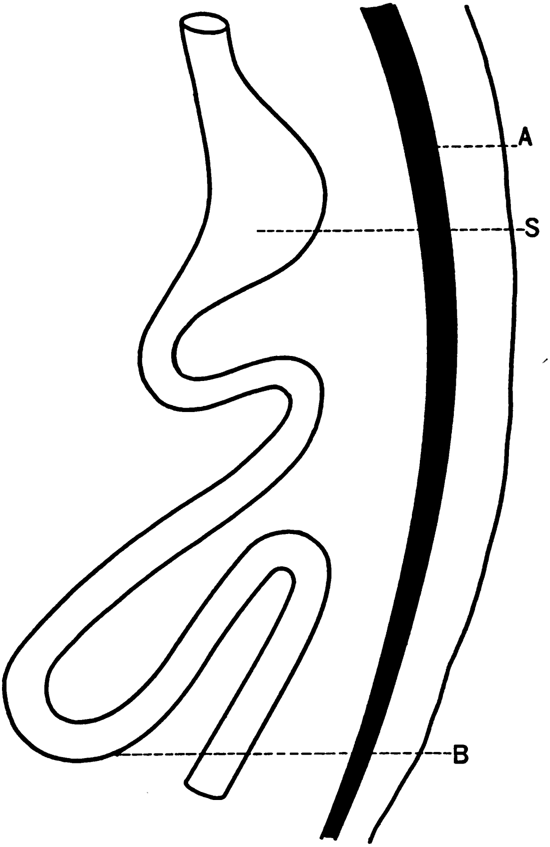

Fig. III.—S, Stomach. A, Aorta. B, Bend in intestine.

FIG. IV.

At about this time a differentiation in the size of the intestine takes place. The bend in the large has crossed the small intestine, and just below the stomach two sprout-like processes are given off from the small intestine, one anteriorly and one posteriorly to it. These are the first indications of the liver and pancreas respectively.

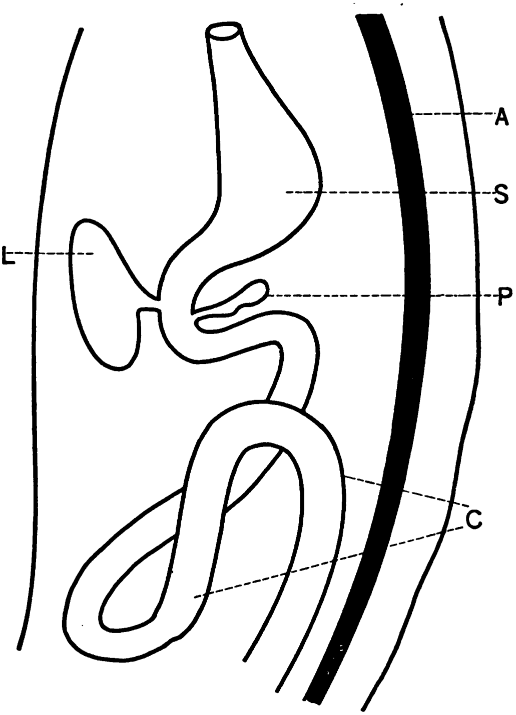

FIG. IV.—S, Stomach. A, Aorta. C, Colon. L, Liver.
P, Pancreas.

FIG. V.

An anterior view of an embryo in the next stage of development shows us that the large intestine has, so to speak, fallen over the small intestine. This happens in such a manner that the large intestine comes to lie anteriorly to the small, crosses it, and indicates in a general way the direction of the transverse and descending colon. The liver and pancreas have not here been drawn in, for the sake of simplicity.

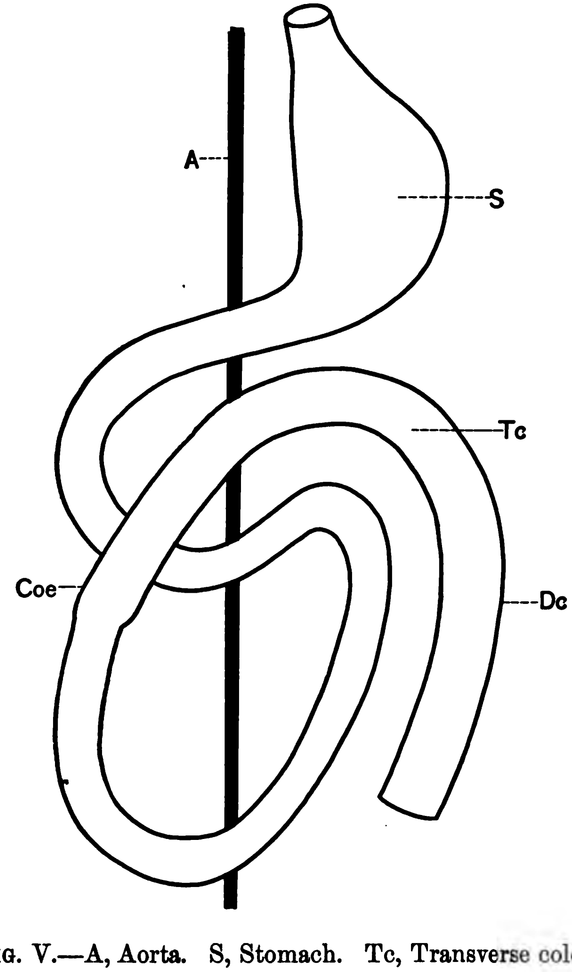

FIG. V.—A, Aorta. S, Stomach. Tc, Transverse colon. Dc, Descending colon. Coe, cæcum.

Fig. VI.

At a later date the differentiation in the size of the intestines is more marked. The vermiform appendix is not of uniform size, as in the adult, but it seems to be, as it really is, a portion of the cæcum. That there is no ascending colon is an important point, as well as the high position of the cæcum. Later, the first portion of the large intestine grows downward, until the cæcum reaches its normal position in the right iliac fossa. In this way the ascending colon is formed. That the cæcum has normally this high position in the embryo is important, for I have seen cases in the dissecting room of children whose cæca were found to be in relation to the liver rather than to the iliac fossa. This abnormity can easily be accounted for by the lack of development of the ascending colon.

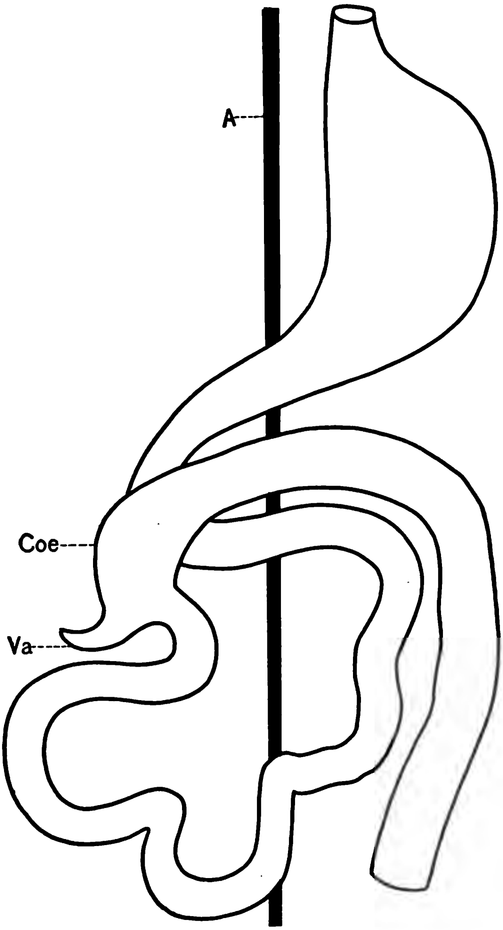

Fig. VI.—Coe, Cæcum. Va, Vermiform appendix.
A Aorta.

Fig. VII.

The stomach has now more its adult form—that is to say, its two ends have approached each other, and, moreover, it is so turned that what was formerly its anterior border is now its superior or lesser curvature, and what was its posterior border is now its inferior or greater curvature. This is important, as we shall see later. The small intestine has greatly increased in length, and the cæcum has reached its normal position, in the right iliac fossa.

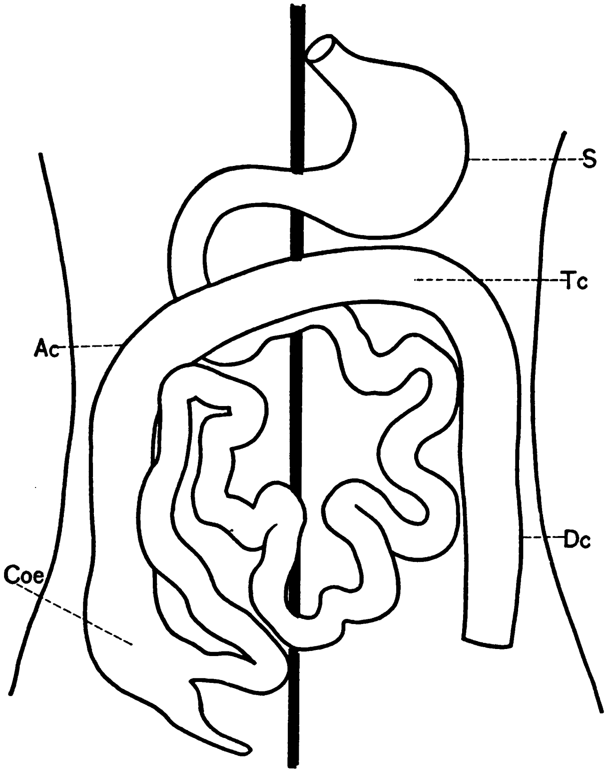

FIG. VII.—S, Stomach. Ac, Ascending colon. Tc, Transverse colon. Dc, Descending colon. Coe, cæcum.

MESENTERY

Fig. VIII.

The blood-vessels supplying the alimentary tract need some support, and they find it in a more or less loose connective tissue which binds them together. It is necessary that they should have a lubricated surface, in order to diminish friction, and so allow the peristaltic movement of the intestines to be carried on as smoothly as possible. So the blood-vessels in their bed of connective tissue are surrounded by a shining membrane called the peritonæum. All these together —vessels, tissue, and peritonæum—constitute what is known as the mesentery.

Every organ has its mesentery, under that name or some other. For instance, the name mesentery is usually applied to the mesentery of the small intestine; the mesocæcum, to the mesentery of the cæcum; the transverse mesocolon, to the mesentery of the transverse colon; and the mesorectum, to the mesentery of the rectum. Moreover, other organs have their mesenteries, though their nature is not designated by their name. The lesser omentum is the mesentery of the liver, the greater omentum the mesentery of the stomach, spleen, and pancreas. It will be seen from this that mesenteries vary much in thickness. They may be very thin, like the omenta, or much stronger, as in the ascending mesocolon.

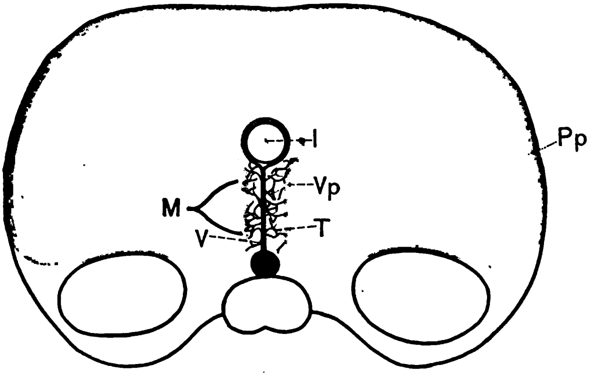

FIG. VIII.—Vp, Visceral peritonæum. Pp, Parietal peritonæum. M, Mesentery. I, Intestine. T, Connective tissue. V, Vessels.

Fig. IX.

Figs. IX, X, and XI are transverse sections of an embryo at different ages, to show two points: first, that the peritonæum is developed simultaneously with the intestine; second, to show the mode of development of the mesentery.

Fig. IX is the youngest embryo, and at this date the intestine is not closed; nevertheless, it is entirely covered by peritonæum (the green line), which is reflected on to the sides of the peritoneal cavity. This shows us that there are two forms of peritonæum—one usually described as the visceral, because it surrounds a viscus; the other as the parietal, because it lines the parietal walls. The peritonæum of the mesentery is always of the former variety. In these drawings the parietal peritonæum will be represented by a green line; but all mesenteries—to show that they are such—by a black line between two green ones. The black line corresponds to the connective-tissue support of the vessels. We see, then, that the peritonæum is developed simultaneously with the intestine, and that the intestine has not, after it has been formed, been pushed into the membrane as a finger is into a glove. This explanation or comparison of the covering of the intestine by peritonæum, which is so often given, is not a fortunate one, for it implies at least a totally wrong principle.

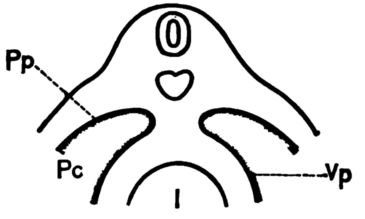

FIG. IX.—Pp, Parietal peritonæum. Vp, Visceral peritonæum. I, Intestine. Pc, Peritoneal cavity.

FIG. X.

Fig. X represents the embryo at a later date. The intestine is gradually closing, and is attached to the embryo by a very short mesentery.

FIG. XI.

In Fig. XI the shape of the embryo is somewhat changed. The intestine is closed, and the mesentery has very much increased in length. It increases in length by growth, which might be likened to a process of stretching.

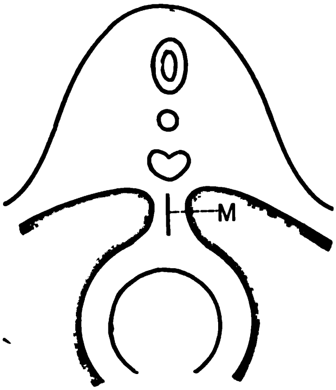

FIG. X.—M, Mesentery.

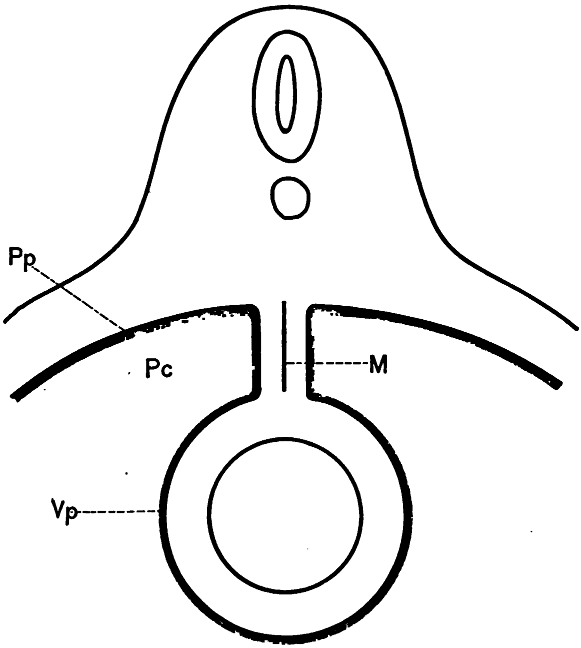

FIG. XI.—Pc, Peritoneal cavity. Pp, Parietal peritonæum. Vp, Visceral peritonæum. M, Mesentery. I, Intestine.

Fig. XII.

For the sake of simplicity, when considering the development of the alimentary canal, its mesenteries were omitted. On the examination of a very young embryo at a period when its alimentary canal presents a tube-like appearance, we find that it possesses two mesenteries—a posterior mesentery, attached anteriorly to the alimentary canal and posteriorly to the aorta. Its vessels (not here represented) are branches of the aorta. It has also an anterior mesentery, attached posteriorly to the canal and anteriorly to the median line of the abdominal wall. This mesentery extends only as far downward as the umbilicus. The abdominal cavity is lined anteriorly and posteriorly, as well as on each side, by the parietal peritonæum, which is reflected on to the mesenteries, and thence on to the gut, constituting the visceral layer of peritonæum (Fig. XX).

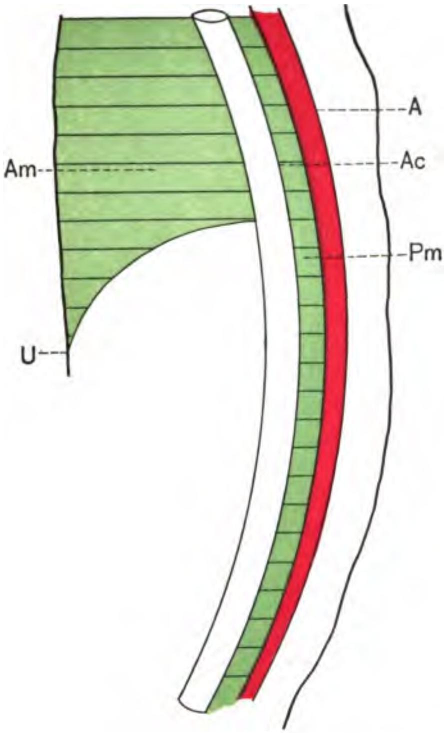

FIG. XII.—A, Aorta. Ac, Alimentary canal. Pm, Posterior mesentery. Am, Anterior mesentery. U, Umbilicus.

FIG. XIII.

The relation of the anterior mesentery is unchanged by the development of the bend in the canal. The posterior, however, presents a somewhat different appearance. This mesentery appears to be shortened where the inferior bend occurs. The stomach and the first part of the small intestine have an anterior as well as a posterior mesentery. The posterior mesentery of the stomach is also called the mesogastrium.

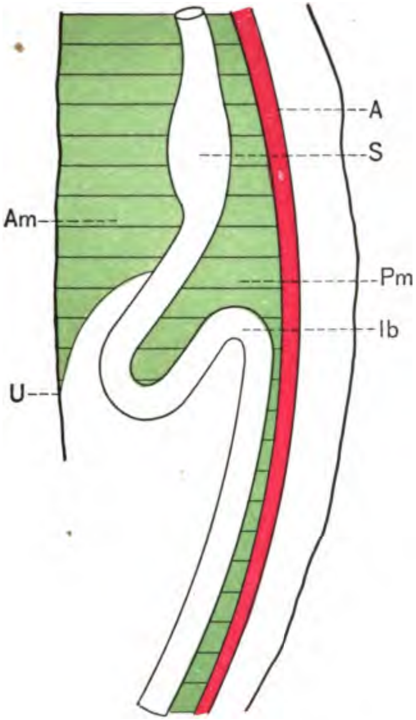

Fig. XIII.—A, Aorta. S, Stomach. Pm, Posterior mesentery or mesogastrium. Am, Anterior mesentery. Ib, Inferior bend. U, Umbilicus.

FIG. XIV.

The blood-vessels have been represented in this plate to show that even at this early date the vessels supplying the organs correspond to the vessels in the adult — the cocliac axis, to supply the stomach, liver, and spleen; the superior mesenteric artery, to supply the cæcum, ascending and transverse colon; the inferior mesenteric, to supply the descending colon, sigmoid flexure, and rectum.

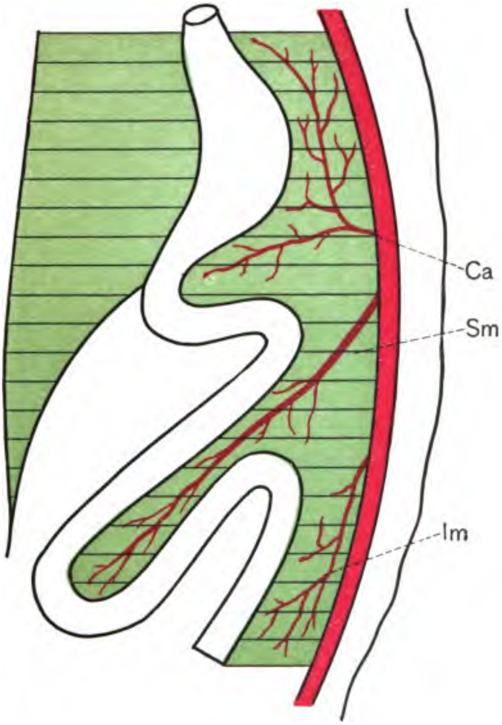

FIG. XIV.—Ca, Cœliac axis. Sm, Superior mesenteric artery. Im, Inferior mesenteric artery.

FIG. XV.

The posterior mesentery is somewhat changed in appearance by the crossing of the intestine. The loop of intestine, with its mesentery, seems to be separated from the posterior mesentery, yet it is not; its connecting band lies between the two parts of the crossing intestine, but can not be seen in this plate. The liver develops from the intestine and lies in the anterior mesentery. The pancreas likewise originates from the intestine, but lies in the posterior mesentery or mesogastrium.

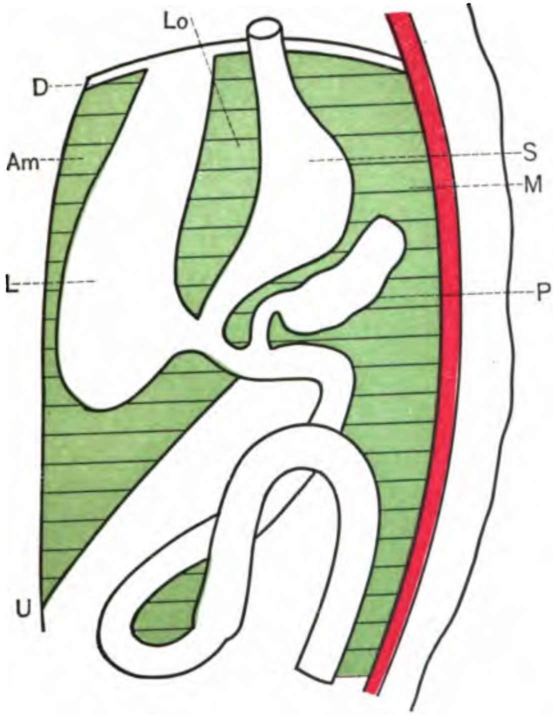

FIG. XV.—Lo, Lesser omentum. S, Stomach. M, Mesogastrium. P, Pancreas. D, Diaphragm. L, Liver. Am, Anterior mesentery. U, Umbilicus.

Fig. XVI.

Fig. XVI is an anterior view of the embryo, representing the alimentary canal after the large has fallen over the small intestine. In this plate the anterior mesentery has been entirely omitted, and all the mesentery here seen is posterior mesentery. The mesogastrium is attached to the median line; it then disappears behind the stomach; it is again seen appearing from behind the stomach, to be attached to its greater curvature.

It must be borne in mind that the stomach has now materially altered its position. Its two ends have approximated each other. It has so turned that what was formerly its anterior border is now its lesser curvature, and what was its posterior border is now its greater curvature. We saw that the posterior mesentery was attached to the posterior border of the stomach and to the aorta. Now, as the greater curvature corresponds to what was the posterior border of the organ, and as the mesogastrium has not changed its place of attachment, we find it attached to the greater curvature of the stomach. Moreover, what was formerly the left surface of the stomach has now become its anterior surface, and its right has become its posterior surface. This would explain the distribution of the left pneumogastric nerve to the anterior and the right to the posterior surface of the stomach.

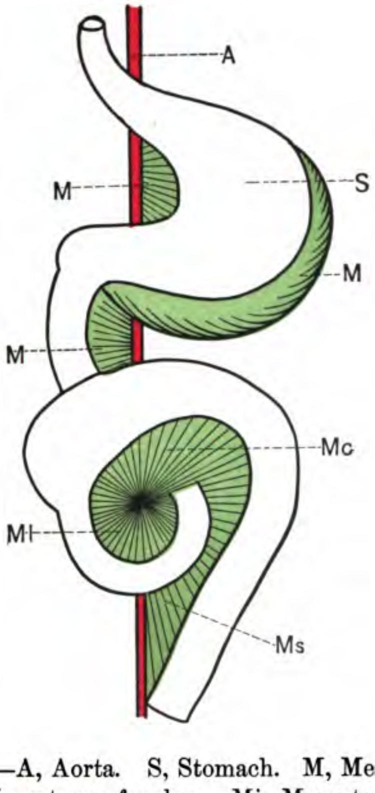

FIG. XVI.—A, Aorta. S, Stomach. M, Mesogastrium. Mc, Mesentery of colon. Mi, Mesentery of intestine. Ms, Mesentery of sigmoid flexure.

FIG. XVII.

If it is not easily understood how a portion of the duodenum is hidden from view by the mesentery of the transverse colon, any one can demonstrate it for himself by the construction of a very simple model. Take a board and fasten to it an India-rubber tube, bent in such a way as to resemble the bend in the embryo intestine. A thin sheet of India-rubber (such as dentists use for their rubber dam) makes a very good posterior mesentery. This should be sewed to the tube and attached to the surface of the board. Now we have a side view of the embryonic alimentary canal with its posterior mesentery.

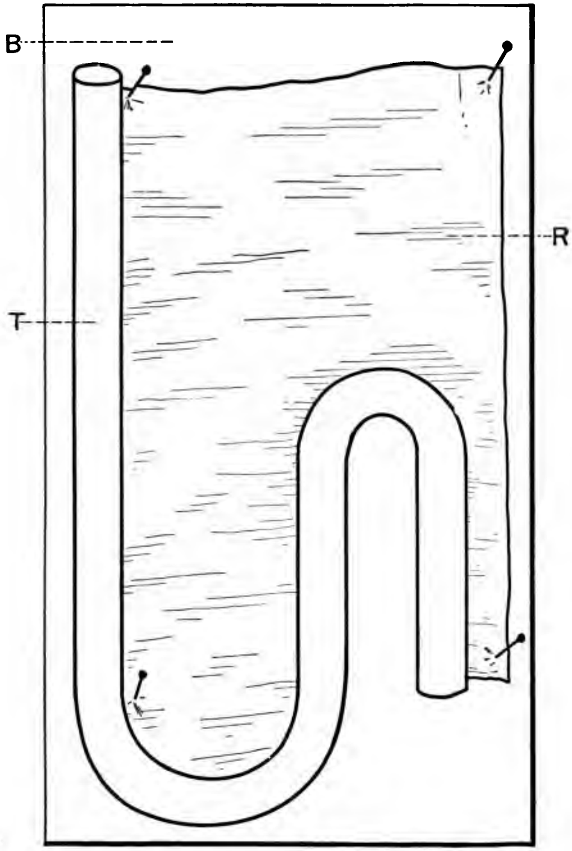

FIG. XVII.—B, Board. T, Tube. R, Rubber sheet.

Fig. XVIII.

The ascending portion of the bend should be approximated to the descending until the loop falls over, and it will be seen that a part of the tube is covered by the rubber sheet (the edge of the board corresponding to the front of the embryo should now be turned toward the observer). This sheet represents the mesentery of the transverse colon, the covered rubber tube the so-called third portion of the duodenum, and, in the model, now to see it one must tear through the rubber sheet. Thus it is explained how in the adult the jejunum seems suddenly to appear in the abdomen, and the third portion of the duodenum is invisible. This portion of the duol denum is covered by the mesentery of the transverse colon, and if this is cut through the duodenum wil- come to light in the same way the tube did when the rubber sheet was torn.

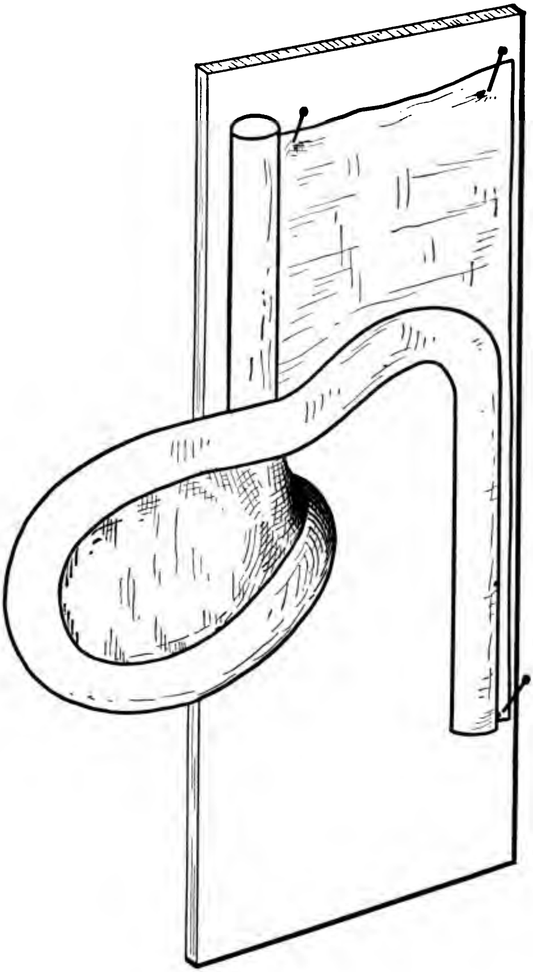

FIG. XVIII.

Fig. XIX.

Fig. XIX is the same as Fig. XVI, only at a later date. The mesogastrium is seen to be more developed, so that it forms quite a little sac behind and to the left as well as below the stomach. After it has reached this period of growth it is spoken of either as the posterior mesentery of the stomach, the mesogastrium, or the great omentum, the names being applied to one and the same thing. The interior of the sac—i. e., the space between the mesogastrium and the stomach—is known as the lesser cavity of the peritonæum, or the cavity of the great omentum.

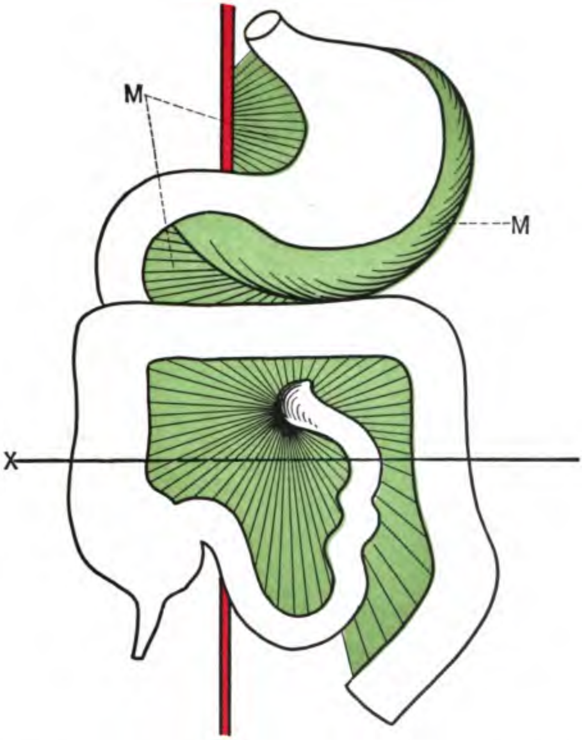

FIG. XIX.—X, Line of section of Fig. XX. M, Mesogastrium.

MESENTERY OF THE INTESTINE IN EMBRYO.

Fig. XX.

Suppose a transverse section of Fig. XIX be made just below the transverse colon. We should see the mesentery of the small intestine, as well as the mesentery of the ascending and descending colon, all attached posteriorly to the aorta; the abdominal cavity lined by the parietal peritonæum; the kidneys lying external to it, in what is known as the retro-peritoneal space (consequently they are covered only on their anterior surfaces by peritonæum). The important point is that both the large and small intestines have a long and freely movable mesentery, and are in no way fixed in the abdomen, except where their mesenteries are attached to the aorta. This is the actual condition of the intestines in the fœtus, and often even at birth.

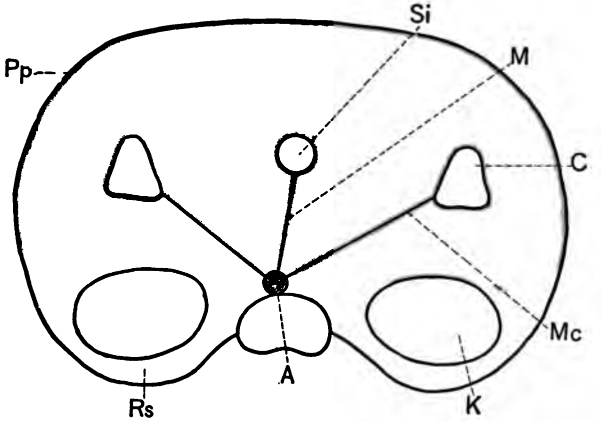

FIG. XX.—Si, Small intestine. M, Mesentery. C, Colon. Mc, Ascending mesocolon. K, Kidney. A, Aorta. Rs, Retroperitoneal space. Pp, Parietal peritonæum.

Fig. XXI.

In the adult, however, it is different. The small intestine remains unchanged, but the ascending and descending colon become adherent to the posterior abdominal wall. That is to say, the parietal peritonæum, as well as the peritonæum on the posterior surface of their mesenteries and a portion of the peritonæum on the colon itself, becomes changed to connective tissue (represented in the plate in brown). By means of this connective tissue the ascending and descending colon, at or soon after birth, become immovably fixed to the posterior abdominal wall. It explains, moreover, how it comes about that they are only partially covered by peritonæum, and how it is possible in the adult, but not in a very young child, to enter the ascending or descending colon posteriorly without injury to the peritonæum. In this operation the operator would pass through the connective tissue, and the peritoneal covering of the gut would remain uninjured. It is interesting to note (speaking generally) that the intestines of the higher animals as regards this point resemble the condition found in the fœtus.

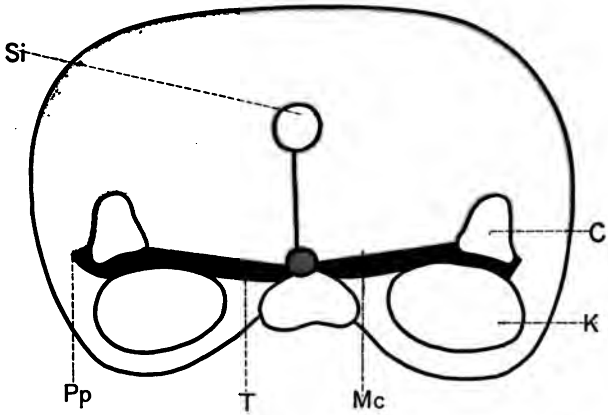

FIG. XXI.—C, Colon. K, Kidney. Mc, Ascending mesocolon. T, Connective tissue. Pp, parietal peritonæum. Si, Small intestine.

Fig. XXII.

In the adult, as was just explained, the mesentery of the descending colon becomes attached to the posterior abdominal wall. The mesentery of the sigmoid flexure, however, is usually only attached, as in the embryo, to the median line, and does not unite with the peritonæum of the posterior abdominal wall. It is long, and consequently very movable—so much so in fact that the ancients described the normal position of sigmoid flexure to be on the right side of the body. An unattached sigmoid flexure is the rule, but to find it more or less united is not uncommon.

Fig. XXII represents the descending colon and sigmoid flexure with their mesenteries. The dotted line shows the limit, inferiorly, to which the mesentery of the descending colon is attached to the posterior abdominal wall. As the sigmoid flexure is not usually attached here, but is quite movable, one is able to lift it up, and will find on so doing a more or less triangular cavity or fossa beneath it. This fossa is bounded in the median line by the attached mesentery of the sigmoid flexure, and above by the dotted line representing the limit of the attachment of the mesentery of the descending colon. It is called the subsigmoid fossa. Its size depends upon the extent of attachment of the mesentery of the sigmoid flexure to the posterior abdominal wall. If this line of attachment extends lower down than normal, so as to include a part of the sigmoid flexure, the fossa will be poorly developed; if, on the other hand, the entire mesentery of the sigmoid flexure is free, the fossa will be large.

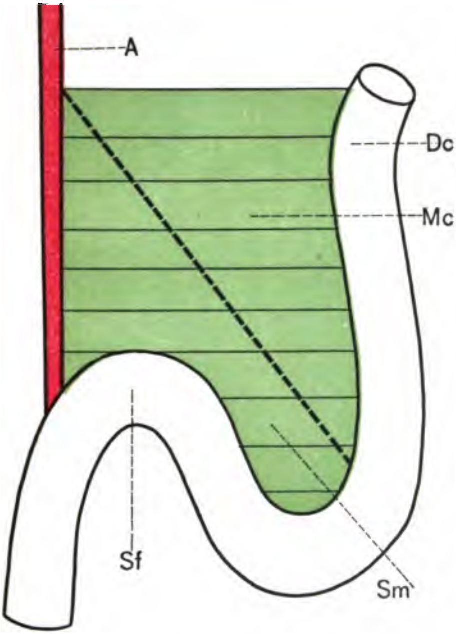

FIG. XXII.—A, Aorta. Dc, Descending colon. Mc, Descending mesocolon. Sm, Sigmoid mesocolon. Sf, Sigmoid flexure.

MESENTERIES OF THE LIVER AND STOMACH.

Fig. XXIII.

In a median section of a young embryo the liver is seen developing in the anterior mesentery of the stomach and duodenum. It divides this mesentery into what is called the anterior mesentery of the liver and the anterior mesentery of the stomach or lesser omentum. From the first moment the liver is distinguishable it is connected not only to the intestine, but also to the diaphragm. It is, in fact, a part of the latter, and it is of the utmost importance to always think of it as an appendage to the diaphragm, and at no period of life separate from it. The pancreas is seen developing in the mesogastrium.

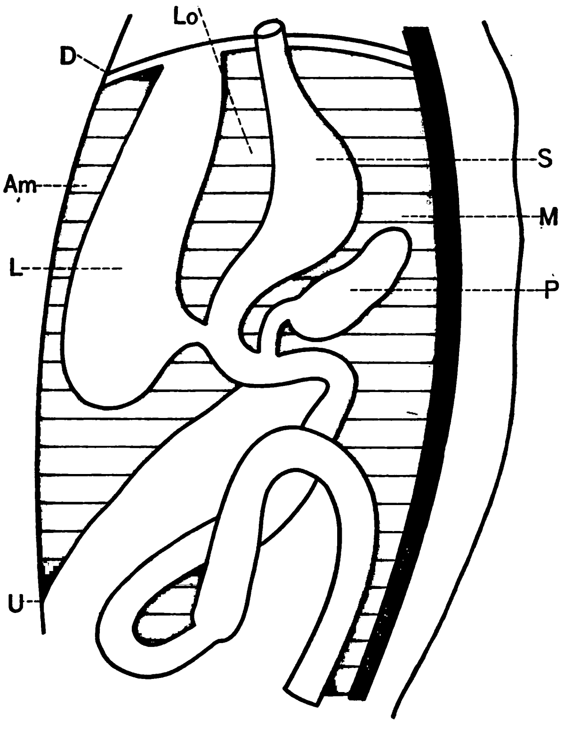

FIG. XXIII.—Lo, Lesser omentum. S, Stomach. M, Mesogastrium. P, Pancreas. D, Diaphragm. L, Liver. Am, Anterior mesentery. U, Umbilicus.

Fig. XXIV.

A transverse section through the stomach of the same embryo would present this picture: The peritoneal cavity lined by its parietal peritonæum; the stomach connected with the posterior abdominal wall by its mesogastrium or greater omentum; with the liver by its anterior mesentery or lesser omentum; and, lastly, the liver connected with the anterior abdominal wall by its anterior mesentery.

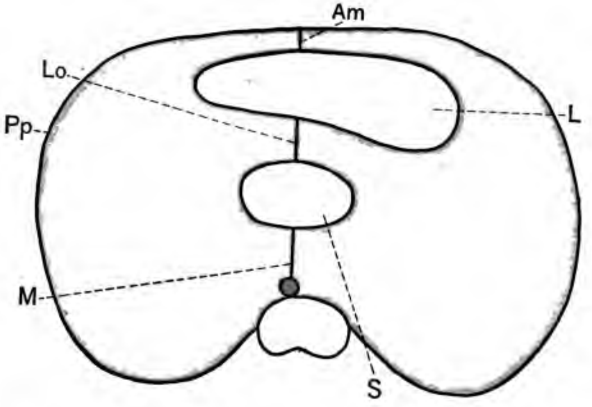

FIG. XXIV.—Am, Anterior mesentery of liver. L, Liver. S, Stomach. Lo, Lesser omentum. Pp, Parietal peritonæum. M, Mesogastrium.

Fig. XXV.

This sketch differs from the last in that the embryo is older, and consequently the organs are more developed. The stomach and liver present much the same appearance as in the last drawing, but the pancreas has been included in this plate. The mesogastrium is longer—it seems curved—and, what is very important, is the appearance of the spleen. This organ is not only developed in, but also from, the mesogastrium.

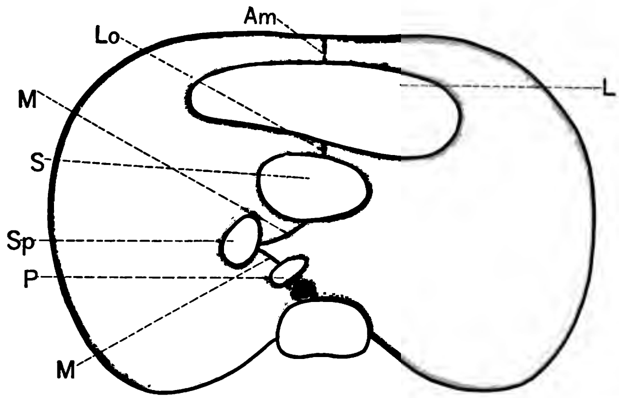

FIG. XXV.—L, Liver. S, Stomach. Sp, Spleen. P, Pancreas. Am, Anterior mesentery. Lo, Lesser omentum. M, Posterior mesentery.

Fig. XXVI.

A sagittal section of an embryo about the same age as in the last sketch would present this appearance: In Fig. XXV the great omentum was developing laterally, and now it is seen also to have grown downward as well, so as to form a distinct sac. The pancreas has been met in the section, and is contained within the mesogastrium.

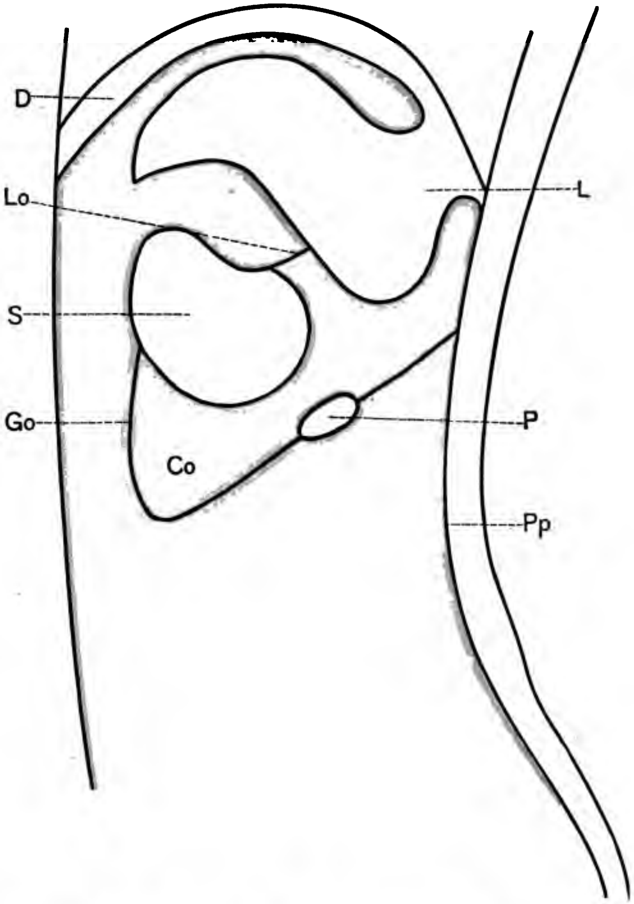

FIG. XXVI.—L, Liver. P, Pancreas. Pp, Parietal peritonæum. Go, Great omentum or mesogastrium. S, Stomach. Lo, Lesser omentum. D, Diaphragm. Co, Cavity of greater omentum.

FIG. XXVII.

A very diagrammatic view of only the greater omentum and the stomach, seen from before, may make the last two drawings plainer. It must always be borne in mind that the change in the position of the stomach (as described on page 34) has materially altered the direction of the omenta. They both pass much more in a transverse, inferior direction than they formerly did. Moreover, the great omentum, although still attached posteriorly to the median line, has developed very much to the left, as well as inferiorly. It does not, in other words, make a straight line between the aorta and greater curvature of the stomach, but passes to the left of the stomach, descends, and then ascends once more to attach itself to the greater curvature, and in this way forms the sac, as before mentioned, which is the cavity of the great omentum or lesser cavity of the peritonæum.

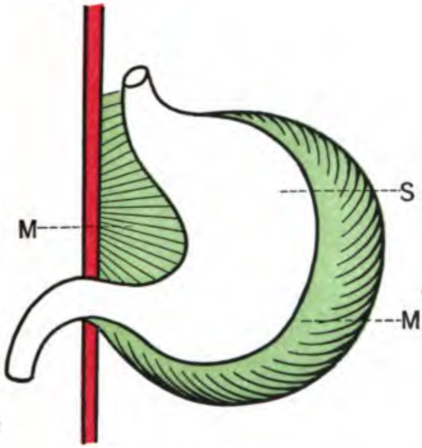

Fig. XXVII.—S, Stomach. M, Posterior mesentery, mesogastrium, or great omentum.

Fig. XXVIII.

Owing to the mentioned change in the position of the stomach, as well as to a further development in the shape of the organs, this section differs materially from the last. The section has passed between the liver and stomach, dividing the lesser omentum. This seems to be attached to the greater curvature or to the posterior surface of the stomach, but this is not the case. It is still attached to the lesser curvature, the erroneous impression being due to the change in the position of the stomach, and consequently a change in the direction of the lesser omentum. The spleen is seen as before, but more developed, and the lateral inclination of the great omentum is marked. The pancreas is still surrounded by the peritonæum, derived from the great omentum, but it is now resting upon the parietal peritonæum. This picture would correspond to the condition of the pancreas just before birth, or, at times, in a very young child—enveloped by the peritonæum of its mesentery, and resting upon the posterior parietal peritonæum. The position of the kidneys is unchanged. They lie in the retroperitoneal space.

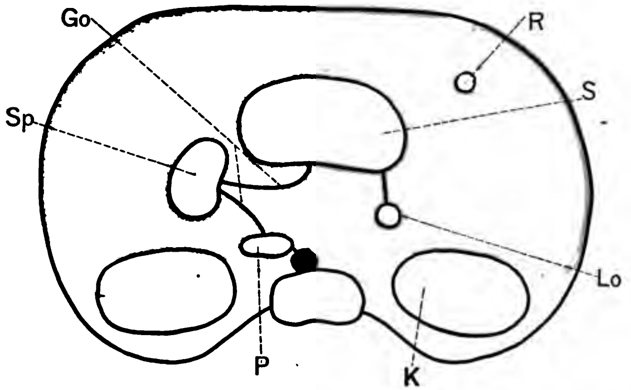

Fig. XXVIII.—R, Round ligament of the liver. S, Stomach. Lo, Lesser omentum with vessels going to the liver. K, Kidney. P, Pancreas. Sp, Spleen. Go, Great omentum.

Fig. XXIX.

The change at this stage is marked, and corresponds to what is generally found at birth. The layer of parietal peritonæum posterior to the pancreas, as well as the visceral layer on its posterior surface, derived from the mesogastrium, have been changed to connective tissue. The pancreas has consequently entirely lost its posterior peritoneal covering. The spleen and stomach are more developed, and the great omentum extends still farther to the left. It has now increased laterally to such an extent that it forms quite an extensive sac behind the stomach, which, as was before mentioned, is known as the lesser cavity of the peritonæum. Between the vessels going to the liver and the aorta this lesser cavity connects with the greater peritoneal cavity, or, in other words, with the rest of the abdominal cavity. The connection is made through a restricted opening bounded anteriorly by the vessels going to the liver in the lesser omentum and posteriorly by the aorta (or, more accurately, by the vena cava, which is not drawn in). This opening is the foramen of Winslow.

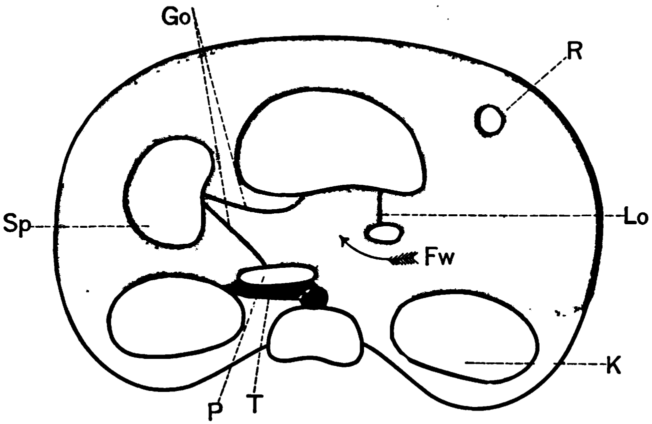

FIG. XXIX.—R, Round ligament of the liver. Lo, Lesser omentum. Fw, Foramen of Winslow. K, Kidney. T, Connective tissue. P, Pancreas. Sp, Spleen. Go, Great omentum.

Fig. XXX.

A sagittal section of a child at or just before birth would present this appearance: The liver united to the diaphragm and covered by the parietal peritonæum, reflected from the diaphragm as well as by the visceral peritonæum reflected from the lesser omentum; the lesser omentum between liver and stomach; the stomach covered by peritonæum derived from its mesenteries (the greater and lesser omentum); the great omentum extending downward from the greater curvature of the stomach and forming the downward projection of the lesser cavity of the peritonæum; the pancreas lying behind the peritonæum (the parietal peritonæum posterior to it as well as its posterior visceral layer, derived from the great omentum, is seen to have changed to connective tissue). The pancreas is now only covered on its anterior and inferior surfaces by peritonæum, both derived from the great omentum. The transverse colon is here drawn in with its mesentery.

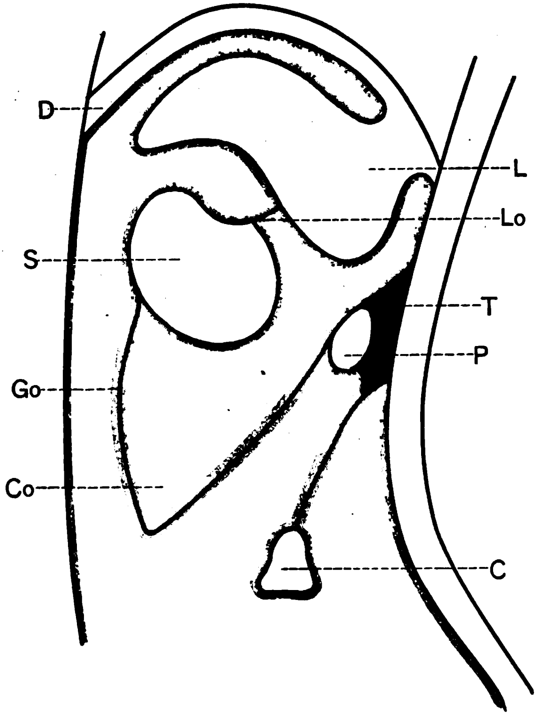

FIG. XXX.—L, Liver. Lo, Lesser omentum. T, Connective tissue. P, Pancreas. C, Colon. D, Diaphragm. S, Stomach. Go, Great omentum. Co, Cavity of great omentum.

Fig. XXXI.

At or soon after birth the picture is somewhat modified. The posterior layer of the great omentum has become adherent to the transverse colon and its mesentery, so that, were the greater omentum lifted up, the colon would be raised with it. By the union of the great omentum with the transverse mesocolon the inferior surface of the pancreas becomes covered by the latter, its former peritoneal covering, derived from the great omentum, having been changed to connective tissue. So it is now covered anteriorly by the great omentum, and inferiorly by the transverse mesocolon.

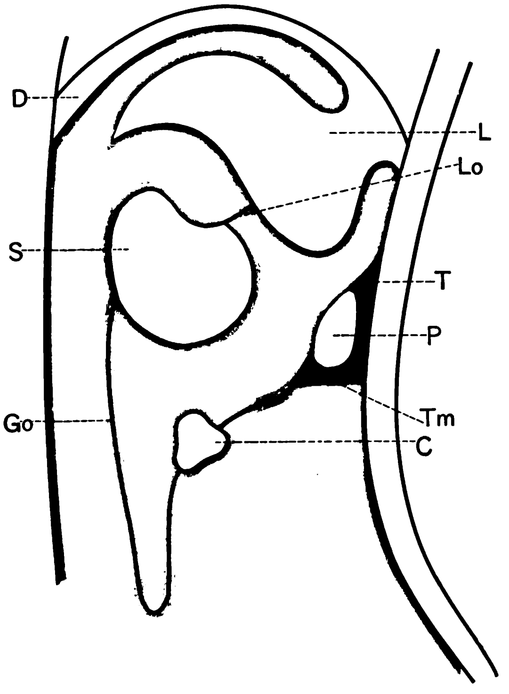

FIG. XXXI.—Lo, Lesser omentum. P, Pancreas. T, Connective tissue. C, Colon. Tm, Transverse mesocolon. Go, Great omentum. L, Liver. D, Diaphragm.

Fig. XXXII.

A transverse section of the abdomen of an adult which passes through the stomach shows a further extension of the great omentum to the left and a greater production of connective tissue behind it where it becomes adherent to the abdominal wall. This connective tissue covers the left kidney, and in the adult can usually be demonstrated on the left side as a distinct layer, which is entirely absent on the right.

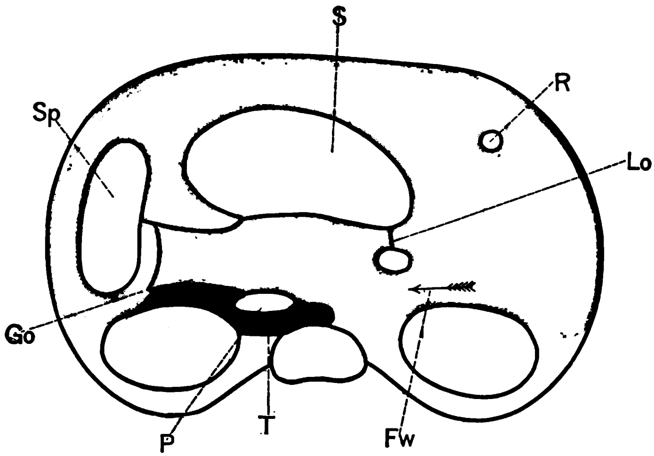

FIG. XXXII.—S, Stomach. Sp, Spleen. P, Pancreas. Lo, Lesser omentum. Go, Great omentum. T, Connective tissue. Fw, Foramen of Winslow. R, Round ligament of liver.

DUODENUM.

Fig. XXXIII.

Fig. XXXIII is a transverse section of the duodenum in embryo. At this period the entire duodenum has a posterior mesentery, and is covered by peritonæum. The first portion has also an anterior mesentery. In the adult this portion is entirely covered by peritonæum derived from its mesenteries. The anterior mesentery is a part of the lesser omentum, and is often called the hepatico-duodenal ligament.

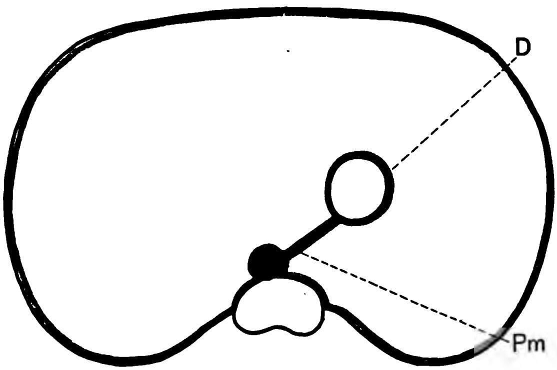

FIG. XXXIII.—Du, Duodenum in embryo. Pm, Posterior mesentery.

Fig. XXXIV.

Fig. XXXIV represents a transverse section of the second portion of the duodenum after birth. The parietal peritonæum behind the second portion (some little time before birth), as well as the posterior peritonæum of its mesentery, are changed to connective tissue, so that at an early date the second portion of the duodenum is only partially covered by the peritonæum.

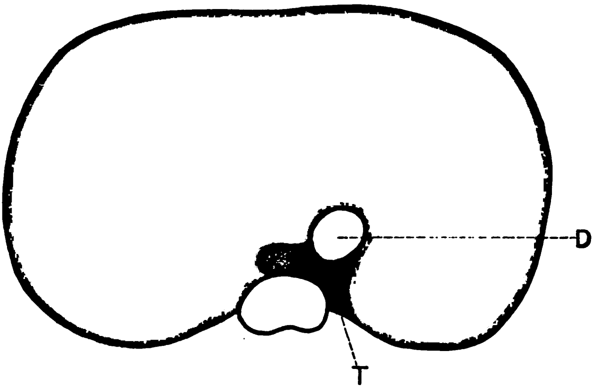

FIG. XXXIV.—Du, Second portion of adult duodenum.
T, Connective tissue.

FIG. XXXV.

To understand the third portion we shall have to return to a young embryo, and to that period of development when not only the transverse colon is ununited with the posterior layer of the great omentum, but when the pancreas is in the great omentum. At this date, as was before mentioned, the duodenum has its posterior mesentery.

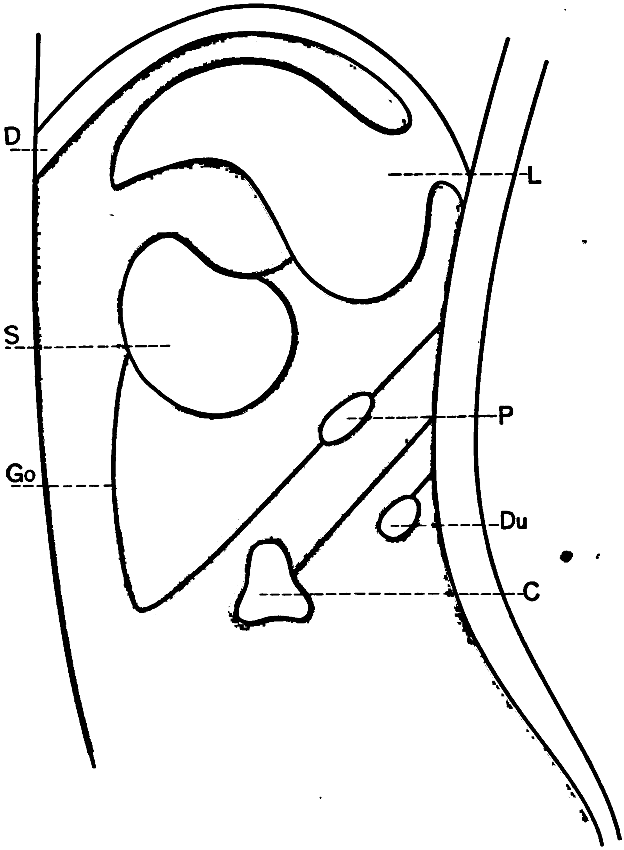

FIG. XXXV.—L, Liver. P, Pancreas. Du, Duodenum. C, Colon. Go, Great omentum. S, Stomach. D, Diaphragm.

Fig. XXXVI.

This plate is the same as Fig. XXX, except that the duodenum is represented. It still has its mesentery. The transverse colon has not yet united with the posterior layer of the great omentum, so the pancreas is covered anteriorly as well as inferiorly by the peritonæum of the great omentum.

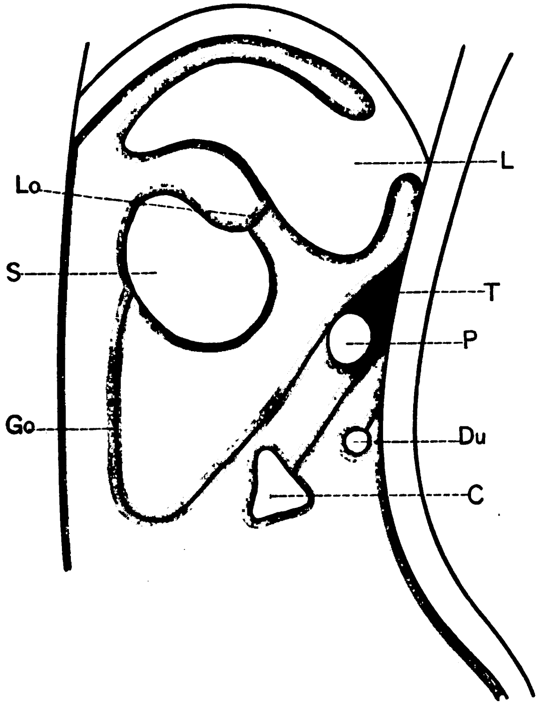

Fig. XXXVI.—L, Liver. T, Connective tissue. Du, Duodenum. C, Colon. Go, Great omentum. S, Stomach. Lo, Lesser omentum. P, Pancreas.

Fig. XXXVII.

At a still later date—not only after the ascending and descending colons have become adherent to the posterior abdominal wall, but also after the transverse colon and mesocolon have united with the great omentum—the parietal peritonæum posterior to the third portion of the duodenum is changed to connective tissue, as well as the visceral layer on its posterior surface. [It must always be borne in mind that, by means of the turn in the intestine, that this portion of the duodenum lies posterior to the transverse mesocolon.] Its anterior and superior visceral layers unite with the transverse mesocolon, and are changed to connective tissue.

In this way the third portion of the duodenum loses its peritoneal covering and comes to lie behind the peritonæum in the retro-peritoneal space, as well as posterior to, and covered anteriorly by, the transverse mesocolon.

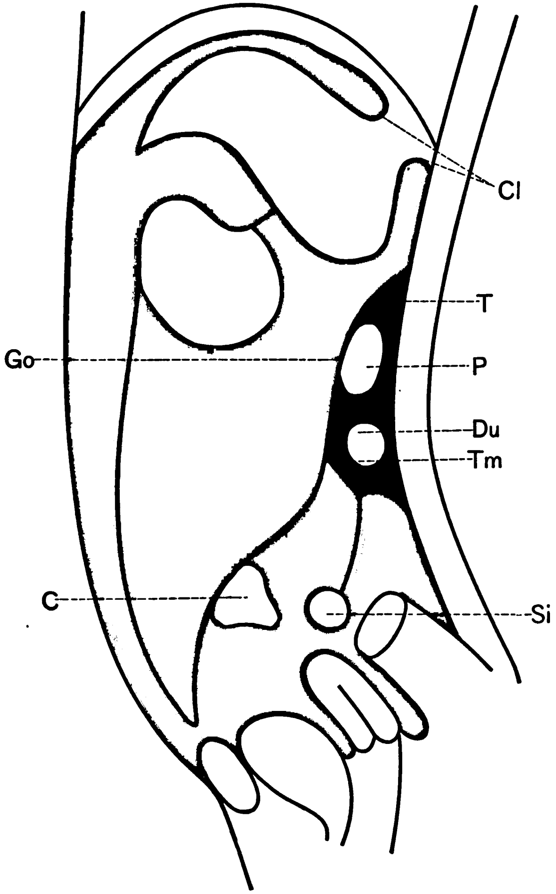

Fig. XXXVII.—Cl, Coronary ligament. Du, Duodenum. Tm, Transverse mesocolon. Si, Small intestine. C, Colon. P, Pancreas. T, Connective tissue. Go, Great omentum.

STOMACH.

In the embryo this organ possesses an anterior and a posterior mesentery. The anterior is attached to the median line of the abdominal wall and to the anterior border of the stomach; the posterior mesentery to the aorta and to the posterior border of the stomach (Fig. XIII). Later, through the change in the position of the organ, the anterior mesentery, or gastro-hepatic ligament, is attached to the lesser curvature; the posterior mesentery, or mesogastrium, to the greater curvature. These two mesenteries are also called the lesser and greater omentum, respectively. The former is the mesentery of the liver, the latter the mesentery of the spleen, pancreas, and stomach (Figs. XXIV and XXVI). At a still later date the great omentum ceases to pass in a direct line from its aortal attachment to the greater curvature, but makes a bend to the left and extends downward below the stomach, returning to be attached to the greater curvature.

Thus the great omentum forms a sac which extends posteriorly, to the left, and below the stomach (Fig. XXVIII). This sac is known as the lesser cavity of the great omentum, and communicates with the greater peritoneal cavity by means of the foramen of Winslow. This foramen is situated inferior to the

caudate lobe of the liver, posterior to the lesser omentum, and anterior to the vena cava (Fig. XXIX). It might be mentioned that more or less fat is developed in the descending and ascending layers of the great omentum, which forms a protection to the intestines. After the adhesion of the transverse colon to the great omentum a further adhesion of its two leaves takes place, and so obliterates the cavity of the great omentum inferior to the transverse colon. The stomach at all periods of life is covered by reflections of visceral peritonæum derived from its mesenteries.

It might be well here to repeat that the posterior mesentery of the stomach is a synonym for mesogastrium, and that after it has developed sufficiently to form a sac it is called the great omentum. The anterior mesentery of the stomach, gastro-hepatic ligament, and lesser omentum, are also synonyms.

SPLEEN.

The spleen is developed from as well as in the mesogastrium. It is at all times entirely surrounded by the visceral peritonæum derived from its mesentery (Figs. XXV, XXVIII, and XXXII). That portion of the great omentum between the spleen and stomach is often referred to as the gastro-splenic ligament.

PANCREAS.

This organ originates from the intestine, and is developed in the mesogastrium (Figs. XV, XXVII, and XXXV).

In the embryo it is surrounded by peritonæum derived from its mesentery. Later the parietal peritonæum posterior to it, as well as its posterior visceral layer, become changed to connective tissue, and in this way it entirely loses its posterior peritoneal covering (Fig. XXIX). After the union of the transverse colon and its mesentery with the posterior layer of the great omentum, the visceral layer, covering the inferior surface of the pancreas, is changed to connective tissue; so that in an adult we find the pancreas covered anteriorly by the peritonæum of the great omentum, inferiorly by the transverse mesocolon, and lying in the retroperitoneal space (Figs. XXXII and XXXI).

LIVER.

The liver originates in a sprout-like process from the intestine, it is developed in the anterior mesentery, and at all periods of life is inseparable from the diaphragm. It should be considered, as it really is, a part of it. If we think of the liver in this way, as

a portion of the diaphragm, not only in the embryo, but also in the adult, our difficulties in understanding the so-called ligaments of the liver will be materially diminished (Fig. XV). The inferior surface of the diaphragm is covered by parietal peritonæum, which is reflected over the liver, and these reflections form some of its ligaments. The gall-bladder is developed by a sprouting process from the gall-duct, and is a part of the liver, just as the liver is a part of the diaphragm. The liver is consequently entirely covered by peritonæum, which is derived from the parietal peritonæum on the inferior surface of the diaphragm, as well as from reflections of visceral peritonæum derived from its mesenteries (Fig. XXXVII). Should we dissect the gall-bladder from the liver, or the liver from the diaphragm, on their attached surfaces there would be no peritoneal covering, any more than there would be if we made a section through the liver and expected to find peritonæum on its cut surface.

Fig. XXXVIII.

This figure represents the so-called posterior surface of the liver after it has been artificially separated from the diaphragm. (The posterior surface is convex, but here has been represented as flat, for the sake of clearness.) Around its diaphragmatic or posterior surface are seen the cut edges of some of the ligaments, which, to repeat, are mostly reflections of peritonæum from the diaphragm. Two of these layers are described as the coronary ligaments, and are attached to the superior and inferior borders of this surface. They end in more or less pointed processes, one on each lobe, to which the name lateral ligament has been given, though they are simply continuations of the coronary. Moreover, the anterior mesentery can be seen, and it is the remains of this mesentery which forms the suspensory ligament. It extends from the diaphragm to the superior surface of the liver, and from the anterior abdominal wall to its anterior border. The umbilical vein limits the anterior mesentery inferiorly. In fact, it is contained in its folds, surrounded by it, but not completely, for on its anterior surface it is destitute of peritoneal covering (Fig. XXVIII). This vein in the embryo enters the umbilical fissure on the inferior surface of the liver, and is continued by means of the ductus venosus to the vena cava, which is situated on its so-called posterior surface. After birth these veins are obliterated, and constitute the remains of the ductus venosus and the round ligament of the liver. In the drawing, between the ductus venosus and vena cava, the Spigelian lobe is seen, which is, of course, covered by peritonæum, as it is a part of the free surface of the organ.

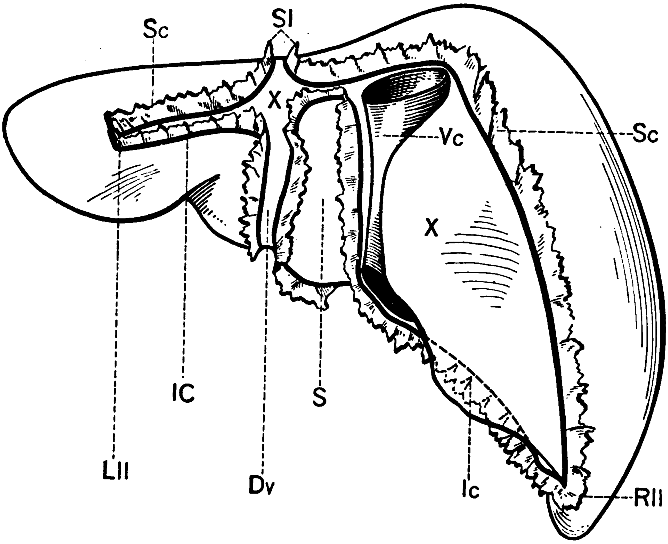

Fig. XXXVIII.—Vc, Vena cava. Sc, Superior coronary ligaments. Ic, Inferior coronary ligaments. S, Spigelian lobe. All, Right lateral ligament. Lll, Left lateral ligament. Sl, Suspensory ligament (anterior mesentery). Dv, Ductus venosus. X, Diaphragmatic or posterior surface of liver which is uncovered by peritonæum.

JEJUNUM AND ILIUM.

These portions of the small intestine have a mesentery, are freely movable, and are at all periods of life covered by peritonæum (Fig. XXI).

CÆCUM.

The relation of the peritonæum to the cæcum is very variable. It has a mesentery, which may be long, but is more often short, and the cæcum is completely covered by peritonæum. It may, however, become adherent to the side of the abdominal wall, and the parietal as well as a part of its visceral layers may be changed to connective tissue; in which case it would be only partially covered.

ASCENDING AND DESCENDING COLONS.

In the embryo the ascending and descending colons have a long, free mesentery. They are quite movable, and entirely covered by peritonæum (Fig. XX). Just before birth the colon with its mesentery becomes adherent to the posterior parietal peritonæum. The latter is changed to connective tissue as well as the visceral layer on the posterior surface of the mesocolon and colon. In this way the colon

becomes fixed to the posterior abdominal wall, and is only partially covered by peritonæum (Fig. XXI).

TRANSVERSE COLON.

This, like the other portions of the large intestine, in the embryo has a long mesentery; is very movable, and is covered by peritonæum (Fig. XXXVI). Later, after the development of the great omentum, the visceral peritonæum on the superior surface of the transverse mesocolon, as well as that on the colon, becomes changed to connective tissue and adheres to the posterior layer of the great omentum. Its anterior surface is then covered by the visceral peritonæum of the posterior layer of the great omentum. Its posterior surface remains unchanged (Fig. XXXVII). So the transverse colon at all periods of life is covered by peritonæum.

SIGMOID FLEXURE.

The mesentery of the sigmoid flexure is attached to the aorta, and is usually long and movable. The gut is entirely covered by peritonæum.

RECTUM.

The first portion of the rectum has a mesentery attached to the median line. The organ is entirely covered by peritonæum. The posterior visceral peritonæum on the second portion of the rectum is changed to connective tissue, so that the organ becomes fixed, and is only partially covered by peritonæum. The third portion of the rectum is destitute of peritoneal covering.

KIDNEY.

At all periods of life these organs lie behind the peritonæum in the retroperitoneal space (Figs. XX, XXI, and XXXII).

There is nothing further to add, as regards the relation of the peritonæum to the rectum, uterus, and bladder, than is given in the text-books of anatomy.

THE END.

DUE DATE

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